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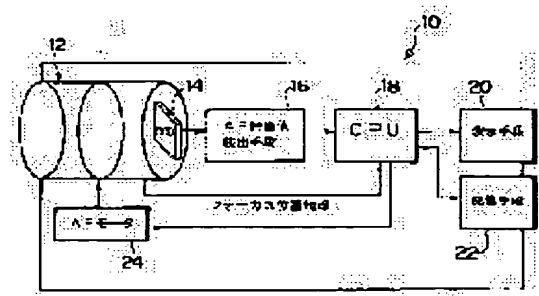
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(54) AUTOMATIC FOCUSING CAMERA AND PHOTOGRAPHING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device and a method for automatic focusing which can obtain an image put in focus on a subject that a user intends even when subjects differing distances are present together by measuring the distances to the subjects in a subject image and taking pictures at each focusing position.

SOLUTION: This camera is provided with a focusing position information measuring means which can measure movement positions on the image pickup plane of a lens group 12 or CCD 14 for focusing on subjects present in a photographic range more than once, and equipped with an AF motor 24 which moves the image pickup plane of the lens group or CCD 14 to the respective focusing position measured by the measuring means in order and a photographing means which takes a picture each time the image pickup plane of the lens group or CCD 14 moves to each focusing position, so even when subjects differing in distance are present together, an image put in focus on a subject that a user intends can be obtained.



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CLAIMS

[Claim(s)]

[Claim 1] The autofocus camera carry out having had the measurement means which two or more migration locations can measure [of the focal lens for making two or more photographic subjects which exist in photographic coverage focus separately, respectively, or an image pick-up side], the focal accommodation means make each migration location measured by said measurement means carry out the sequential migration of said focal lens or the image pick-up side, and the photography means take a photograph whenever said focal lens or an image pick-up side move with said focal accommodation means in each migration location as the feature.

[Claim 2] Said measurement means is the autofocus camera of claim 1 which carries out extract addition of the high frequency component from an output signal of said photography means for every migration location of this focal lens or an image pick-up side, and is characterized by to measure 1 from which an evaluation value is computed and this evaluation value serves as a peak thru/or two or more of said focal lenses, or a migration location of an image pick-up side while moving said focal lens or an image pick-up side in the direction of an optical axis.

[Claim 3] Said measurement means is the autofocus camera of claim 1 characterized by measuring a migration location of said focal lens which makes a photographic subject of each photographic subject distance focus separately, respectively, or an image pick-up side while having two or more ranging area and measuring photographic subject distance for every ranging area.

[Claim 4] A photography method which measure a focal lens for making it focus separately to two or more photographic subjects which exist in photographic coverage, respectively, or two or more migration locations of an image pick-up side, and said each measured migration location is made to carry out sequential migration of said focal lens or the image pick-up side, and is characterized by to take a photograph whenever said focal lens or an image pick-up side moves to each migration location.

[Claim 5] It is the photography method of claim 4 characterized by to measure measurement of said migration location based on the migration location of said focal lens with which an evaluation value computes by carrying out extract addition of the high frequency component from an output signal of said photography means for every migration location of this focal lens or an image pick-up side, and this evaluation value serves as a peak, or an image pick-up side while it moves said focal lens or an image pick-up side in the direction of an optical axis.

[Claim 6] Measurement of said migration location is the photography method of claim 4 characterized by measuring photographic subject distance for two or more ranging area of every, and measuring a migration location of said focal lens or an image pick-up side based on each photographic subject distance.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the autofocus camera and the photography method of starting an autofocus camera and the photography method, especially taking a photograph by making it focus to two or more photographic subjects.

[0002]

[Description of the Prior Art] As a method of making main photographic subjects focusing certainly, the multipoint ranging camera, with which multipoint **** and a camera judge the best point, and make small ranging area focus is shown in the official report of JP,6-313839,A. Moreover, a photography person's look is detected in the official report of JP,6-289279,A, and the camera of preparing ranging area near a look is known.

[0003]

[Problem(s) to be Solved by the Invention] However, by the method shown in the official report of above-mentioned JP,6-313839,A, there was fault of necessarily not agreeing for the photographic subject which a photography person means.

[0004] Moreover, by the method shown in the official report of JP,6-289279,A, while the user was using glasses, when a camera was not able to perceive a user's look easily, the fault of not focusing for the photographic subject to mean had arisen.

[0005] In the conventional autofocus camera, it occurs plentifully that the focus location which the camera judged differs from it focus locating [which a user wishes] as mentioned above. This has a small photographic subject in focus locating [which a user wishes], and when a photographic subject with a large area exists before and behind the focus location of choice, it is easy to generate it. For example, it is the fault which makes a mountain the back, and is frequently generated to a front person when you want a focus.

[0006] This invention was made in view of such a situation, and even if two or more photographic subjects with which distance differs are intermingled, it aims at offering the autofocus camera which can obtain the image which focused for the photographic subject which a user means, and the photography method.

[0007]

[Means for Solving the Problem] A measurement means which can measure a focal lens for making two or more photographic subjects which exist in photographic coverage focus separately, respectively in order that this invention may attain said purpose, or two or more migration locations of an image pick-up side, A focal accommodation means to make each migration location measured by said measurement means carry out sequential migration of said focal lens or the image pick-up side, It is characterized by having a photography means to take a photograph whenever said focal lens or an image pick-up side moves to each migration location with said focal accommodation means.

[0008] A measurement means which can measure a focal lens for making two or more photographic subjects which exist in photographic coverage focus separately, respectively according to this invention, or two or more migration locations of an image pick-up side, A focal accommodation means to make each migration location measured by said measurement means carry out sequential migration of said focal lens or the image pick-up side, Since it had a photography means to take a photograph whenever said focal lens or an image pick-up side moves

to each migration location with said focal accommodation means, even if two or more photographic subjects with which distance differs are intermingled, it becomes possible to obtain an image which focused for a photographic subject which a user means.

[0009]

[Embodiment of the Invention] It explains in full detail about the gestalt of desirable operation of the autofocus camera applied to this invention according to an accompanying drawing below, and the photography method.

[0010] Drawing 1 is the block diagram showing the gestalt of operation of the electronic camera with which the automatic-focusing (it omits Following AF) camera concerning this invention and the photography method were applied.

[0011] The optical system of an electronic camera 10 is equipped with the taking-lens group 12 which can adjust a focus, and CCD (solid state image sensor)14 which changes a photographic subject image into an electrical signal. The image pick-up signal acquired by CCD14 is transmitted to AF evaluation value detection means 16. With AF evaluation value detection means 16, after changing an image pick-up signal into digital R, G, and B signal, contrast performs processing which extracts a large component. Furthermore, a photographic subject image is divided into each area, the contrast in each area is totaled and averaged, and it outputs to CPU18.

[0012] Moreover, CPU18 is equipped with ROM which is a read-only storage means by which the program which manages the actuation of RAM and CPU18 which can be written, and which is a storage means, the constant, etc. are stored.

[0013] A display means 20 to display photography data, and a storage means 22 to perform record or read-out of photography data are connected to CPU18. Moreover, the AF motor 24 which is a means to adjust the focus (focus) of the lens group 12 is connected to CPU18, and a focus can be adjusted by the command from CPU18. In addition, the focal positional information which is the distance information on the image pick-up side of the lens group 12 and CCD14 is measurable, and this positional information is inputted into CPU18. Moreover, while ordering an electronic camera 10 AF and AE in the 1st step, the release switch which orders it photography in the 2nd step and which is not illustrated is formed.

[0014] Although the lens group 12 is moved in the direction of an optical axis and focal accommodation is performed with the configuration of a means to adjust the above-mentioned focus, even if it moves CCD14 which is an image pick-up side in the direction of an optical axis and performs focal accommodation, it becomes possible to attain the purpose of this invention.

[0015] The AF method of the electronic camera 10 constituted as above-mentioned is explained.

[0016] At first, the focus of the lens group 12 is standing by in the location of long distance teleradiography most. Image formation of the image to photo is carried out to the light-receiving side of a solid state image sensor (CCD) 14 through the taking-lens group 12. And this photographic subject image is changed into the signal charge of the amount according to the amount of incident light of light by each sensor in CCD14. Thus, the accumulated charge signal is transmitted to AF evaluation value detection means 16, and AF evaluation value for judging the focus in the case of R for every pixel, G, and B signal being changed into digital R, G, and B signal here, and performing an automatic focus in a high frequency component extract circuit (focus location) is computed.

[0017] With AF evaluation value detection means 16, the difference of the brightness between the pixels which adjoin the high frequency component of the data of the photographic subject image divided into AF addition field of 8x8, for example is computed as contrast. Contrast is searched for in each field, the contrast in each field is totaled and averaged, and it outputs to CPU18 as an AF evaluation value.

[0018] Thus, a focal location is moved from infinite distance to the nearest location, and AF evaluation value in each focal location is calculated. That is, if AF evaluation value of sigmaA1 in the 1st point of infinite distance is measured, CPU18 will output next the command which moves one step of lens groups 12 to the “**” side in accordance with an optical axis to the AF motor 24. [of a focus] since there will be few point of measurement of AF evaluation value and it will end if it is set as the width of face of the depth of field changed according to the narrowing-down condition of drawing which is not a drawing example, one step at this time can time improvement in the speed of AF.

[0019] And it asks for AF evaluation value sigmaA2, sigmaA3, and sigmaA4— like the following, and AF search is performed. And the focal location where AF evaluation value shows maximum is computed in AF evaluation value of sigmaA1 to sigmaA13, and the location is judged to be a focus location. And a photograph is taken, doubling a focus with the focal location. Moreover, when the curve which connects AF evaluation values of an adjoining focal location has two or more point of inflection, the point of inflection which becomes convex may be judged to be a focus location.

Thus, when two or more calculation of the focus location is carried out, a photograph is taken in each focus location, and each data is memorized by the storage means 22. Moreover, when a background exists in a location distant from a photographic subject and other main photographic subjects are focusing on the near location, the focus location of a background may be deleted, and you may set up in the focus location of a background so that a photograph may not be taken. In addition, when contrast AF is generally performed to the low background of contrast, such as empty, the sea, and a wall, AF evaluation value acquired shows a low value.

[0020] In addition, when this invention is applied to the electronic camera 10 which can rewrite photography data, the data photoed in each focus location is stored temporarily, and it may display later, only required image data may be chosen, and you may memorize for the storage means 22.

[0021] The example of a measurement result of AF search is shown in drawing 2.

[0022] Drawing 2 shows the result of having carried out AF search of the photographic subject image with which main photographic subjects focus and exist in the distance of a focal location "7." sigmaAn (n= 1, 2, 3, —, 13) which is AF evaluation value of this drawing shows maximum in a focal distance of sigmaA7, and the peak has clarified. CPU18 judges that the focal location of sigmaA7 is a focus location here using that sigmaA7 is convex point of inflection, sigmaA7 being maximum, etc. from AF evaluation value of the sigmaA6 and the sigmaA8 grade near sigmaA7.

[0023] The photographic coverage to which a photographic subject image is intermingled in drawing 3 in the location of two or more distance is shown.

[0024] According to this drawing, in photographic coverage 30, the person 32 who is in the place nearest to an electronic camera 10, the automobile 34 which exists in the location distant from the person 32, and the background 36 which exists far away are intermingled. If AF evaluation value in each focal location is computed by performing AF search about the photographic subject image shown in this drawing 3, AF search result shown in drawing 4 will be obtained.

[0025] According to drawing 4, the point of inflection where AF evaluation value is convex is formed near AF evaluation value sigmaB4 in the focal location of a background 36, AF evaluation value sigmaB8 in the focal location of an automobile 34, and the AF evaluation value sigmaB12 in a person's 32 focal location. Therefore, a focal location judges CPU18 that the location of "4", "8", and "12" is a focus location, and a photograph is taken in these focal locations, respectively.

[0026] The timing chart of photography at the time of applying the autofocus camera and the photography method concerning this invention to drawing 5 is shown.

[0027] According to this drawing, if the 1st step of the release switch formed in the electronic camera 10 at time of day t1 is pushed, AF search will be started, and AF evaluation value in each focal location is computed by carrying out step migration of the focal location from "1" to "13." And a focus location is computed between t10 and t11, a focal location is again moved to the location of "12" in t12, and it will be in a photography standby condition. Since it differs from the halt direction from the side which is the halt direction performed at the time of AF search (**), when a focal location stops from a side (**) in case the location of a focal location "12" makes stop a lens group here, when influenced [friction of the drive system of a lens group, or] of backlash, the hysteresis phenomenon which stops in a different location from the location of "12" stopped at the time of AF search occurs. After making it once move to a side [location / of "12"] (**), a focal location is moved toward a side again (**), and it is made to stop in the location of "12" as it shows at the time of day of t11 to t12 of drawing 5 in stopping a focal location "12" in order to solve this problem. In addition, in being the structure where AF drive system does not produce a hysteresis, or (**) (**) even if it makes it stop from which, it does not produce a problem.

[0028] And if the 2nd step of the release switch formed in the electronic camera 10 is pushed, a photograph is taken in the location of a focal location "12", and the location of "8" will be moved to a degree, then, a focal location will be similarly moved with the location of "4", and a

seriography will be performed. When the 2nd step is continuously pushed with the 1st step of the release carbon button of an electronic camera 10, processings from t1 to t17 are performed continuously.

[0029] In addition, since the method of the seriographies from t11 to t17 shown in drawing 5 takes the time amount to which it goes and comes back in order to abolish the hysteresis in the halt location of a focus, photography takes time amount. So, in the case of the "bracket mode" in which photography is continuously performed in two or more focal locations, exposure time can be shortened, if a seriography is carried out once it moves a focal location to a side [locations / all / photography focus] (**) as shown at the time of day of t31 to t35 of drawing 6 .

[0030] In addition, although the example of the autofocus camera using the ranging means of the contrast AF which computes a focus location from the image data outputted from CCD14 explained in the above-mentioned explanation, this invention is not limited to this, and even if a triangulation type, outdoor daylight passive guidance, optical active guidance, an ultrasonic type, etc. use other ranging means, the purpose of this invention is attained. Moreover, it is possible to apply not only to an electronic camera but to the autofocus camera and the photography method of a film-based camera.

[0031]

[Effect of the Invention] According to the autofocus camera and the photography method of starting this invention, as explained above The measurement means which can measure the focal lens for making two or more photographic subjects which exist in photographic coverage focus separately, respectively, or two or more migration locations of an image pick-up side, A focal accommodation means to make each migration location measured by said measurement means carry out sequential migration of said focal lens or the image pick-up side, Since it had a photography means to take a photograph whenever said focal lens or an image pick-up side moves to each migration location with said focal accommodation means, even if two or more photographic subjects with which distance differs are intermingled, it becomes possible to obtain the image which focused for the photographic subject which a user means.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the gestalt of operation of the electronic camera with which the autofocus camera concerning this invention and the photography method were applied

[Drawing 2] Drawing showing the example of a measurement result of AF search

[Drawing 3] Drawing showing the photographic coverage to which a photographic subject image is intermingled in two or more locations

[Drawing 4] Drawing showing the measurement result of AF search of the photographic coverage to which a photographic subject image is intermingled in two or more locations

[Drawing 5] The timing chart of the photography which applied the autofocus camera and the photography method concerning this invention

[Drawing 6] The timing chart of the photography which applied the autofocus camera and the photography method concerning this invention

[Description of Notations]

10 [— AF evaluation value detection means, 18 / — CPU, 20 / — A display means, 22 / — A storage means, 24 / — AF motor, 30 / — Photographic coverage] — An electronic camera, 12 — A lens group, 14 — CCD (solid state image sensor), 16

[Translation done.]

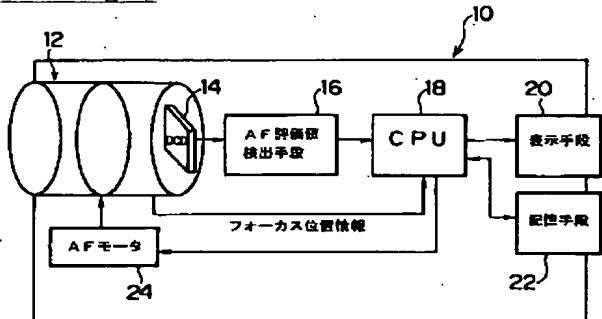
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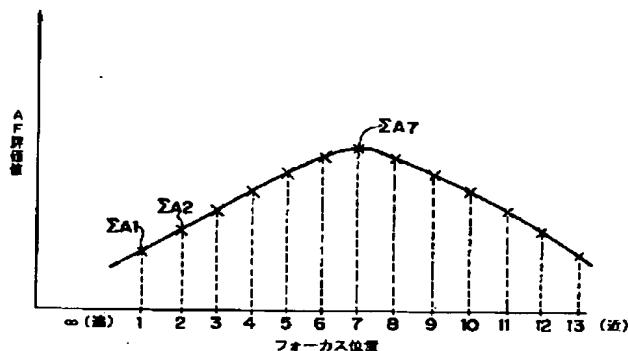
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DRAWINGS

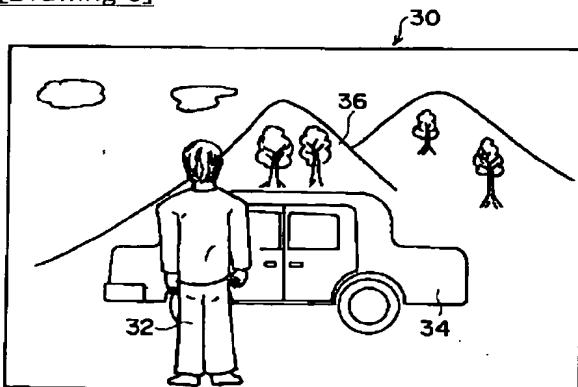
[Drawing 1]



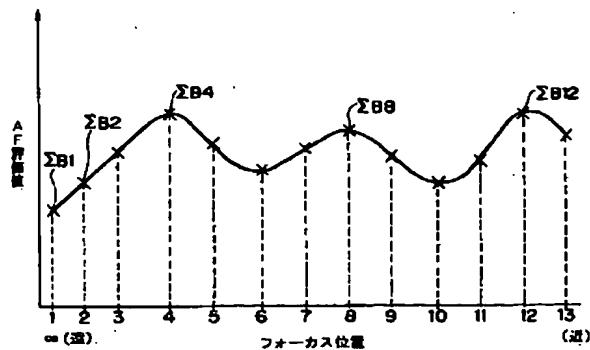
[Drawing 2]



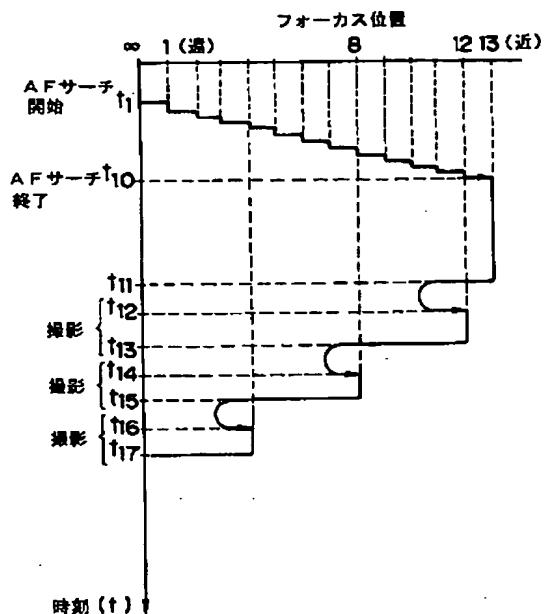
[Drawing 3]



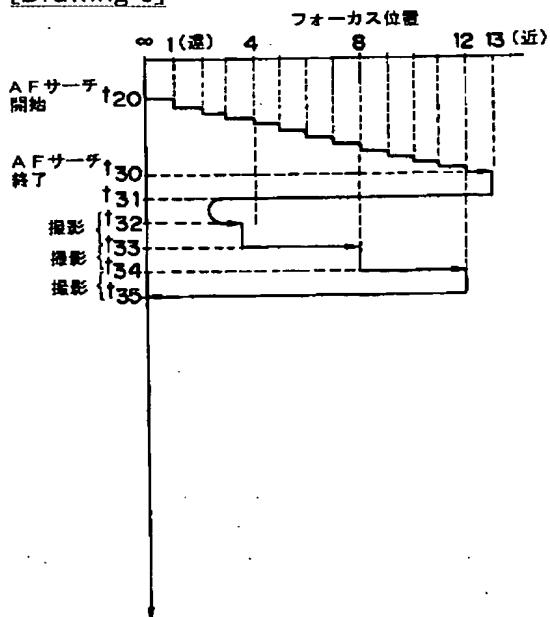
[Drawing 4]



[Drawing 5]



[Drawing 6]



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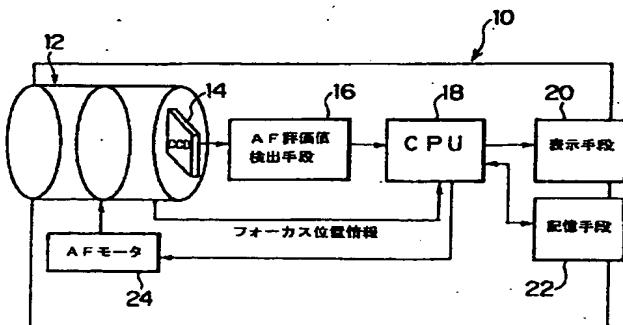
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(54)【発明の名称】 自動焦点カメラ及び撮影方法

(57)【要約】

【課題】被写体像中に存在する複数の被写体までの距離をそれぞれ測距し、それぞれのフォーカス位置にて複数回撮影することにより、距離の異なる複数の被写体が混在していても、利用者が意図する被写体に合焦した画像を得ることが可能なオートフォーカス装置及び方法を提供する。

【解決手段】撮影範囲中に存在する複数の被写体をそれぞれ複数回合焦させるためにレンズ群12又はCCD14の撮像面の複数の移動位置が測定可能なフォーカス位置情報測定手段を設け、前記測定手段により測定された各フォーカス位置に前記レンズ群又はCCD14の撮像面を順次移動させるAFモータ24と、前記レンズ群又はCCD14撮像面が各フォーカス位置に移動するごとに撮影する撮影手段とを備えたので、距離の異なる複数の被写体が混在していても利用者の意図する被写体に合焦した画像を得ることが可能となる。



【特許請求の範囲】

【請求項1】撮影範囲中に存在する複数の被写体をそれぞれ別々に合焦させるためのフォーカスレンズ又は撮像面の複数の移動位置の測定が可能な測定手段と、前記測定手段により測定された各移動位置に前記フォーカスレンズ又は撮像面を順次移動させるフォーカス調節手段と、前記フォーカス調節手段により前記フォーカスレンズ又は撮像面が各移動位置に移動するごとに撮影する撮影手段と、を備えたことを特徴とする自動焦点カメラ。

【請求項2】前記測定手段は、前記フォーカスレンズ又は撮像面を光軸方向に移動させるとともに、該フォーカスレンズ又は撮像面の各移動位置ごとに前記撮影手段の出力信号から高周波成分を抽出積算して評価値を算出し、該評価値がピークとなる1乃至複数の前記フォーカスレンズ又は撮像面の移動位置を測定することを特徴とする請求項1の自動焦点カメラ。

【請求項3】前記測定手段は、複数の測距エリアを有し、各測距エリアごとに被写体距離を測定するとともに、各被写体距離の被写体をそれぞれ別々に合焦させる前記フォーカスレンズ又は撮像面の移動位置を測定することを特徴とする請求項1の自動焦点カメラ。

【請求項4】撮影範囲中に存在する複数の被写体に対してそれぞれ別々に合焦させるためのフォーカスレンズ又は撮像面の複数の移動位置を測定し、

前記測定した各移動位置に前記フォーカスレンズ又は撮像面を順次移動させ、前記フォーカスレンズ又は撮像面が各移動位置に移動するごとに撮影することを特徴とする撮影方法。

【請求項5】前記移動位置の測定は、前記フォーカスレンズ又は撮像面を光軸方向に移動させるとともに、該フォーカスレンズ又は撮像面の各移動位置ごとに前記撮影手段の出力信号から高周波成分を抽出積算して評価値を算出し、該評価値がピークとなる前記フォーカスレンズ又は撮像面の移動位置に基づいて測定することを特徴とする請求項4の撮影方法。

【請求項6】前記移動位置の測定は、複数の測距エリアごとに被写体距離を測定し、各被写体距離に基づいて前記フォーカスレンズ又は撮像面の移動位置を測定することを特徴とする請求項4の撮影方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は自動焦点カメラ及び撮影方法に係り、特に複数の被写体に対し合焦させて撮影を実施する自動焦点カメラ及び撮影方法に関する。

【0002】

【従来の技術】主要な被写体に確実に合焦させる方法として、小さい測距エリアを多点設け、カメラが最良のポイントを判断し合焦させる多点測距カメラが特開平6-

313839号の公報に示されている。また、特開平6-289279号の公報には、撮影者の視線を検知し、視線の近辺に測距エリアを設けるというカメラが知られている。

【0003】

【発明が解決しようとする課題】しかしながら上述の特開平6-313839号の公報に示されている方法では、撮影者の意図する被写体に合致するとは限らないという不具合があった。

【0004】また、特開平6-289279号の公報に示されている方法では、利用者が眼鏡を使用している時には、カメラが利用者の視線を察知しにくくことにより、意図する被写体に合焦しないという不具合が生じていた。

【0005】上記のように従来の自動焦点カメラでは、カメラが判断したピント位置と、利用者の希望するピント位置が異なることが多々発生する。これは、利用者が希望するピント位置にある被写体が小さく、希望ピント位置前後に面積の広い被写体が存在する場合に発生しやすい。たとえば、山をバックにして手前の人物にピントが欲しい場合において頻繁に発生する不具合である。

【0006】本発明はこのような事情に鑑みてなされたもので、距離の異なる複数の被写体が混在していても、利用者の意図する被写体に合焦した画像を得ることが可能な自動焦点カメラ及び撮影方法を提供することを目的としている。

【0007】

【課題を解決する為の手段】本発明は、前記目的を達成するために、撮影範囲中に存在する複数の被写体をそれぞれ別々に合焦させるためのフォーカスレンズ又は撮像面の複数の移動位置の測定が可能な測定手段と、前記測定手段により測定された各移動位置に前記フォーカスレンズ又は撮像面を順次移動させるフォーカス調節手段と、前記フォーカス調節手段により前記フォーカスレンズ又は撮像面が各移動位置に移動するごとに撮影する撮影手段とを備えたことを特徴としている。

【0008】本発明によれば、撮影範囲中に存在する複数の被写体をそれぞれ別々に合焦させるためのフォーカスレンズ又は撮像面の複数の移動位置の測定が可能な測定手段と、前記測定手段により測定された各移動位置に前記フォーカスレンズ又は撮像面を順次移動させるフォーカス調節手段と、前記フォーカス調節手段により前記フォーカスレンズ又は撮像面が各移動位置に移動するごとに撮影する撮影手段とを備えたので、距離の異なる複数の被写体が混在していても利用者の意図する被写体に合焦した画像を得ることが可能となる。

【0009】

【発明の実施の形態】以下添付図面に従って本発明に係る自動焦点カメラ及び撮影方法の好ましい実施の形態について詳説する。

【0010】図1は本発明に係る自動焦点（以下AFと略す）カメラ及び撮影方法が適用された電子カメラの実施の形態を示すブロック図である。

【0011】電子カメラ10の光学系は、フォーカスの調節が可能な撮影レンズ群12と、被写体像を電気信号に変換するCCD（固体撮像素子）14とを備えている。CCD14によって得られた撮像信号はAF評価値検出手段16に伝送される。AF評価値検出手段16では、撮像信号をデジタルのR、G、B信号に変換したのちにコントラストが大きい成分を抽出する処理を行う。更に被写体像を各エリアに分割して、各エリアに於けるコントラストを合計して平均し、CPU18に出力する。

【0012】また、CPU18には読み書き可能な記憶手段であるRAMと、CPU18の動作を司るプログラムや定数等が収められている読み出し専用の記憶手段であるROMが備えられている。

【0013】CPU18には、撮影データを表示する表示手段20と、撮影データの記録または読み出しを行う記憶手段22とが接続されている。またCPU18には、レンズ群12のフォーカス（ピント）を調節する手段であるAFモータ24が接続されており、CPU18からの指令によってフォーカスの調節を行うことができる。なお、レンズ群12とCCD14の撮像面の距離情報であるフォーカス位置情報が測定可能で、該位置情報はCPU18に入力されている。また、電子カメラ10には1段目でAFやAEを指令するとともに、2段目で撮影を指令する図示しないレリーズスイッチが設けられている。

【0014】上記のフォーカスを調節する手段の構成では、レンズ群12を光軸方向に移動させてフォーカス調節を行っているが、撮像面であるCCD14を光軸方向に移動させてフォーカス調節を行っても、本発明の目的を達成することができる。

【0015】上記のとおり構成された電子カメラ10のAF方法について説明する。

【0016】最初、レンズ群12のフォーカスは最も遠距離撮影の位置に待機している。撮影する像は、撮影レンズ群12を介して固体撮像素子（CCD）14の受光面に結像される。そしてこの被写体像はCCD14内の各センサで光の入射光量に応じた量の信号電荷に変換される。このようにして蓄積された電荷信号はAF評価値検出手段16に伝送され、ここで各画素ごとのR、G、B信号がデジタルのR、G、B信号に変換されて高周波成分抽出回路にてオートフォーカスを行う場合のピント（合焦位置）を判定するためのAF評価値が算出される。

【0017】AF評価値検出手段16では、たとえば8×8のAF積算領域に分割した被写体像のデータの高周波成分を、隣接する画素間での輝度の差をコントラスト

として算出する。各々の領域においてコントラストを求め、各領域に於けるコントラストを合計して平均し、AF評価値としてCPU18に出力する。

【0018】このようにしてフォーカス位置を無限遠から最も近い位置まで動かして、各フォーカス位置におけるAF評価値を求める。すなわち、無限遠の1点目におけるΣA1のAF評価値が測定されると、次にCPU18はAFモータ24に対してレンズ群12を光軸に沿ってフォーカスの「近」側に1ステップ移動させる指令を出力する。この時の1ステップは、図示しない絞りの絞り込み具合に応じて変動する被写界深度の幅に設定しておくとAF評価値の測定点数が少なくて済むので、AFの高速化が計れる。

【0019】そして以下同様にしてAF評価値ΣA2、ΣA3、ΣA4…を求めて、AFサーチを行ってゆく。そして、ΣA1～ΣA13のAF評価値の中でAF評価値が最大値を示すフォーカス位置を算出し、その位置を合焦位置と判定する。そしてそのフォーカス位置にフォーカスを合わせて撮影を行う。また、隣接するフォーカス位置のAF評価値どうしを結ぶ曲線が複数の変曲点を持つ場合には、上に凸となる変曲点を合焦位置と判定してもよい。このように合焦位置が複数算出された場合には各々の合焦位置で撮影を行い、それぞれのデータは記憶手段22に記憶される。また、被写体には遠い位置に背景が存在し、その他の主要被写体が近い位置に集中している場合には、背景の合焦位置を削除して、背景の合焦位置では撮影しないように設定してもよい。なお、一般に空、海、壁といったコントラストの低い背景に対してコントラストAFを行うと、得られるAF評価値は低い値を示す。

【0020】なお、本発明を、撮影データの書き換えが可能な電子カメラ10に適用した場合には、各々の合焦位置で撮影したデータを一時記憶しておき、後に表示して必要な画像データのみを選択して記憶手段22に記憶してもよい。

【0021】図2にAFサーチの測定結果例を示す。

【0022】図2では、主要な被写体がフォーカス位置「7」の距離に集中して存在している被写体像をAFサーチした結果を示している。同図のAF評価値であるΣAn（n=1、2、3、…、13）はΣA7のフォーカス距離にて最大値を示しており、そのピークははっきりしている。ここでCPU18は、ΣA7の近傍のΣA6やΣA8等のAF評価値からΣA7が上に凸の変曲点であることや、ΣA7が最大値であること等を用いて、ΣA7のフォーカス位置が合焦位置であることを判定する。

【0023】図3に複数の距離の位置に被写体像が混在する撮影範囲を示す。

【0024】同図によれば、撮影範囲30には、電子カメラ10にいちばん近い所に居る人物32と、人物32

よりも離れた位置に存在する自動車34と、遠方に存在する背景36とが混在している。この図3に示した被写体像に関してAFサーチを実行して各々のフォーカス位置におけるAF評価値を算出すると、図4に示すAFサーチ結果が得られる。

【0025】図4によれば、背景36のフォーカス位置におけるAF評価値ΣB4と、自動車34のフォーカス位置におけるAF評価値ΣB8と、人物32のフォーカス位置におけるAF評価値ΣB12の近傍にてAF評価値が上に凸の変曲点を形成している。したがって、CPU18は、フォーカス位置が「4」と「8」と「12」の位置が合焦位置であると判断して、これらのフォーカス位置でそれぞれ撮影を行う。

【0026】図5に本発明に係る自動焦点カメラ及び撮影方法を適用した場合の撮影のタイミングチャートを示す。

【0027】同図によれば、時刻t1にて電子カメラ10に設けられているリリーズスイッチの1段目が押されるとAFサーチを開始し、フォーカス位置を「1」から「13」までステップ移動して各フォーカス位置におけるAF評価値を算出する。そしてt10からt11の間に合焦位置を算出してt12にてフォーカス位置を「12」の位置に再び移動して撮影スタンバイ状態になる。ここでフォーカス位置「12」の位置にレンズ群を停止させる際に、フォーカス位置を(近)側から停止させてしまうとAFサーチ時に実行した停止方向である(遠)側からの停止方向と異なるので、レンズ群の駆動系の摩擦やバックラッシュの影響を受ける場合にはAFサーチ時に停止した「12」の位置とは異なる位置に停止してしまうヒステリシス現象が発生する。この問題を解決するためには、フォーカス位置「12」に停止させる場合は図5のt11からt12の時刻に示すとおり、一旦「12」の位置より(遠)側に移動させたのちに再び(近)側に向かってフォーカス位置を移動し「12」の位置で停止させる。なお、AF駆動系がヒステリシスを生じない構造である場合には、(近)又は(遠)のどちら側から停止させても問題は生じない。

【0028】そして、電子カメラ10に設けられているリリーズスイッチの2段目が押されたら、フォーカス位置「12」の位置で撮影し、次に「8」の位置、次に「4」の位置と、同様にフォーカス位置を移動して連続撮影を実行する。電子カメラ10のリリーズボタンの1段目と2段目とが連続して押された場合には、t1からt17までの処理を連続して実行する。

【0029】なお、図5に示したt11からt17まで

の連続撮影の方法では、フォーカスの停止位置におけるヒステリシスを無くすために往復する時間を要するので撮影に時間がかかる。そこで、複数のフォーカス位置において連続して撮影を実行する「プラケットモード」の場合には、図6のt31からt35の時刻に示すように、一旦フォーカス位置を全ての撮影フォーカス位置よりも(遠)側に移動させてから連続撮影すると、撮影時間を短縮することができる。

【0030】なお、上記の説明ではCCD14から出力される画像データから合焦位置を算出するコントラストAFの測距手段を用いた自動焦点カメラの例で説明したが、本発明はこれに限定されるものではなく、三角測量式、外光パッシブ式、光アクティブ式、超音波式等、他の測距手段を用いても本発明の目的は達成される。また、電子カメラに限らず銀塩カメラの自動焦点カメラ及び撮影方法にも適用することができる。

【0031】

【発明の効果】以上説明したように本発明に係る自動焦点カメラ及び撮影方法によれば、撮影範囲中に存在する複数の被写体をそれぞれ別々に合焦させるためのフォーカスレンズ又は撮像面の複数の移動位置の測定が可能な測定手段と、前記測定手段により測定された各移動位置に前記フォーカスレンズ又は撮像面を順次移動させるフォーカス調節手段と、前記フォーカス調節手段により前記フォーカスレンズ又は撮像面が各移動位置に移動するごとに撮影する撮影手段とを備えたので、距離の異なる複数の被写体が混在していても利用者の意図する被写体に合焦した画像を得ることが可能となる。

【図面の簡単な説明】

【図1】本発明に係る自動焦点カメラ及び撮影方法が適用された電子カメラの実施の形態を示すブロック図

【図2】AFサーチの測定結果例を示す図

【図3】複数の位置に被写体像が混在する撮影範囲を示す図

【図4】複数の位置に被写体像が混在する撮影範囲のAFサーチの測定結果を示す図

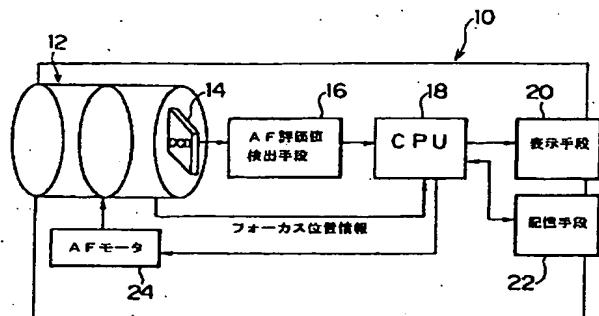
【図5】本発明に係る自動焦点カメラ及び撮影方法を適用した撮影のタイミングチャート

【図6】本発明に係る自動焦点カメラ及び撮影方法を適用した撮影のタイミングチャート

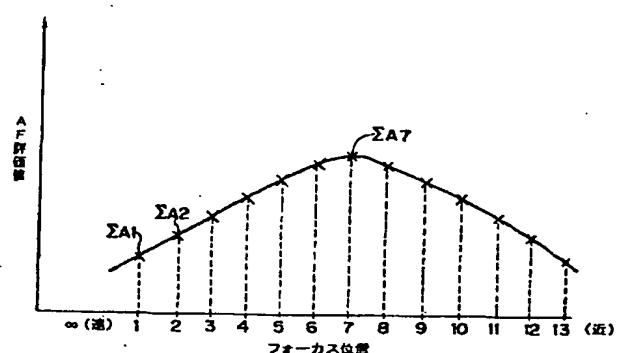
【符号の説明】

10…電子カメラ、12…レンズ群、14…CCD(固体撮像素子)、16…AF評価値検出手段、18…CPU、20…表示手段、22…記憶手段、24…AFモータ、30…撮影範囲

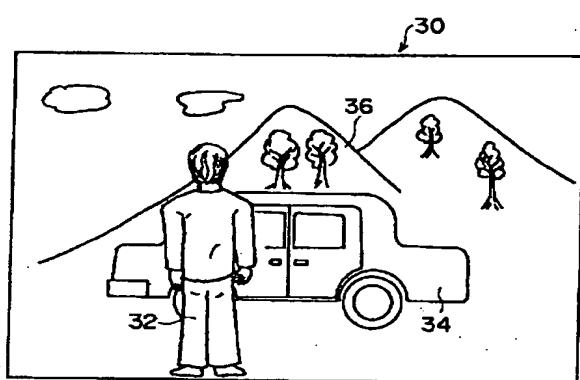
【図1】



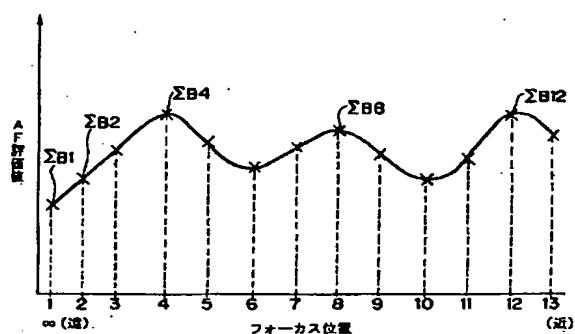
【図2】



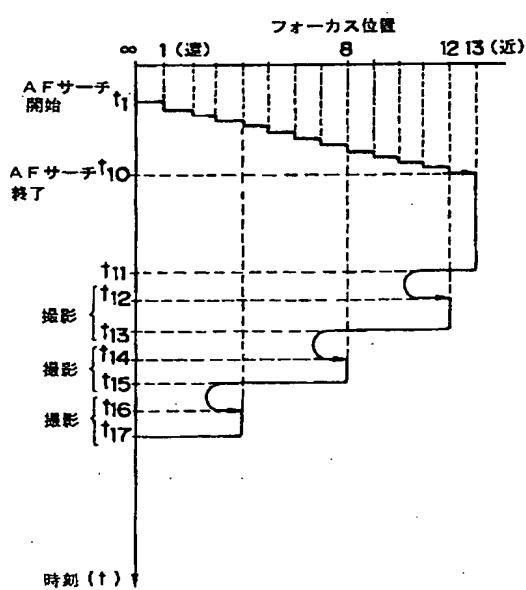
【図3】



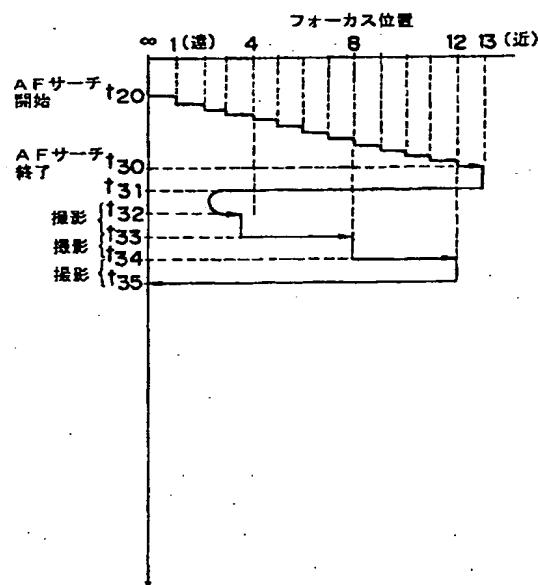
【図4】



【図5】



【図6】



フロントページの続き

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